It does not follow, therefore, that the bright-bands of oxygen are necessarily the brightest parts of the solar spectrum. Other substances may produce lines or bands of greater brilliancy.

There is also another cause for a difference of appearance in a bright-line spectrum produced in a laboratory and bright lines in the Sun. While the edges of a band in the spark spectrum may be nebulous or shaded off, the corresponding band in the solar spectrum may have its edges sharpened by the action of adjacent dark lines due to one or another of the metallic substances in the Sun.

On the whole, it does not seem improper for me to take the ground that, having shown by photographs that the bright lines of the oxygen spark spectrum all fall opposite bright portions of the solar spectrum, I have established the probability of the existence of oxygen in the Sun. Causes that can modify in some measure the character of the bright bands of the solar spectrum obviously exist in the Sun, and these, it may be inferred, exert influence enough to account for such minor differences as may be detected.

In closing, it may be well to give some idea of the amount of labour and time this research has already consumed, and this cannot be better done than by a statement of the production of electrical action that has been necessary. Each photograph demands an exposure of 15 minutes, and, with preparation and development, at least half an hour is needed. The making of a photograph, exclusive of intermediate trials, requires, therefore, about 30,000 10-inch sparks, that is 30,000 revolutions of the bobbin of the Gramme machine. In the last three years the Gramme has made 20 millions of revolutions. The petroleum engine only consumes a couple of drops of oil at each stroke, and yet it has used up about 150 gallons. Each drop of oil produces two or three 10-inch sparks. It must also be borne in mind that comparison spectra can only be made when the Sun is shining, and clouds therefore are a fertile source of loss of time.

London, June 10, 1879.

On the Photographic Semi-diameter of the Moon.

By Professor C. Pritchard.

In the course of measuring the Lunar Photographs which have been obtained in the Oxford University Observatory by means of the De La Rue Reflector of 13 inches aperture, it occurred to me, for the purposes simply of acquiring confidence or otherwise in the laborious processes which have been undertaken, to compare the mean semi-diameter of the Moon thereby obtained with the mean semi-diameter adopted in the *Nautical Almanac*; and also to compare the photographic results with

similar results deduced from Wichmann's measures made with the Königsberg Heliometer in 1844.

The process of computation adopted at Oxford is very nearly the same as that proposed by Bessel and employed by Wichmann. Two small but well-defined craters were selected on the photographs, viz. *Ptolemy*, A, and *Triesnecker*, B; the latter being purposely chosen on account of its close proximity to the mean centre of the Moon's disk. A few measures have also been taken with *Hypatia*, B.

Distances from each of these craters were measured to six or seven points on the Moon's limb, arbitrarily but conveniently selected, and subtending known measured angles at the particular crater. These distances and angles were measured by means of Mr. De La Rue's engine, the scales and screws of which had been previously examined with scrupulous care. By methods well known to astronomers these data afford equations of condition for the determination of the photographic diameter of the Moon, as seen at the moment from the place of observation.

From each of these local and apparent semi-diameters, the mean geocentric diameter of the Moon has been computed by means of the formula

$$\Delta = \frac{\sin \varpi}{\sin p} \cdot D,$$

where D is the geocentric semi-diameter at the time of observation, p the corresponding parallax, Δ the geocentric semi-diameter at the mean distance, and ϖ the mean parallax. Twenty of these determinations thus obtained are tabulated below, and are printed in column II.

In column III. are printed the differences of the several values in column II. from the arithmetic mean ($15' \, 34''\cdot175$) given at the bottom of the column; the examination of these residuals by well-known methods shows that the probable error of the mean diameter of the Moon thus obtained is $\pm 0''\cdot069$. The mean geocentric semi-diameter in use in the *Nautical Almanac* appears to be $15' \, 34''\cdot10$; and the remarkably close agreement between these two results, thus obtained by methods entirely independent of each other, warrants, I think, confident reliance on the accuracy of the photographic method.

It is, however, to be carefully noticed that, while this preliminary and partial investigation may, it is hoped, attract the interest of the Society to a novel but most careful application of photography, nothing beyond this general accuracy of the method is here sought to be established.

With regard to Wichmann's measures, it may be remarked that the instrument he used was the Königsberg Heliometer, and that he reduced his resulting measures by nearly the same methods as those adopted at Oxford. In column IV. I have given the resulting differences between the local semi-diameters

thus computed and the corresponding ones given in the *Berliner Jahrbuch*, in which Ephemeris Burckhardt's values are adopted. The probable error of the mean of twenty consecutive semi-diameters is about $\pm 0''\cdot13$, being nearly double that which attaches to the photographic results.

From a remark found in Wichmann's most able paper, it appears that the mean value of the Moon's semi-diameter as obtained from the whole series of his measures, fifty in number, differs from that obtained from his twenty consecutive measures, by a quantity far too inconsiderable to be taken into account.

The Heliometer having hitherto been considered the most accurate instrument for the measurement of comparatively small distances, it seems desirable to place the results of the heliometric and the photographic methods in juxtaposition.

Column I. Observed Crater.	Column II. Moon's Mean semi-diameter. ′ ″	Column III. Difference from Arithmetic Mean (15′ 34″·175). ″	Column IV. *Berliner Jahrbuch* semi-diameter 1844 —Heliometer measure. ″
Triesnecker, B.	15 34·295	0·120	−0·164
Ptolemy, A.	15 33·931	0·244	−0·907
Triesnecker, B.	15 34·820	0·645	+0·013
	15 34·315	0·140	−0·854
	15 34·568	0·393	−1·132
Ptolemy, A.	15 34·150	0·025	−1·457
Triesnecker, B.	15 33·457	0·718	−1·196
	15 34·031	0·144	−0·511
Ptolemy, A.	15 34·591	0·416	−0·453
Triesnecker, B.	15 34·380	0·205	−1·454
Ptolemy, A.	15 34·801	0·626	−0·878
	15 34·787	0·612	−3·332
	15 33·884	0·291	−2·475
Hypatia, B.	15 34·262	0·087	−1·080
	15 33·590	0·585	−0·694
	15 34·178	0·003	−0·242
	15 34·271	0·096	−0·536
	15 33·280	0·895	−2·294
	15 33·469	0·706	−1·849
Ptolemy, A.	15 34·447	0·272	−0·252

The mean of the above photographic semi-diameters is $15' \, 34''\cdot175$, with a probable error of $\pm 0''\cdot069$. The comparison of columns III. and IV. will furnish an idea of the results which may be expected from the two methods of measurement. Further details will be given in the next fasciculus of the Oxford University Observatory, to be published at an early date in next year.